# High-Power PNP Silicon Transistors

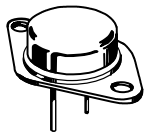
**2N6437**
**2N6438***

*Motorola Preferred Device

. . . designed for use in industrial–military power amplifier and switching circuit applications.

- High Collector–Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 100 Vdc (Min) — 2N6437
  = 120 Vdc (Min) — 2N6438
- High DC Current Gain —
  $h_{FE}$ = 20–80 @ $I_C$ = 10 Adc
  = 12 (Min) @ $I_C$ = 25 Adc
- Low Collector–Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 1.0 Vdc (Max) @ $I_C$ = 10 Adc
- Fast Switching Times @ $I_C$ = 10 Adc
  $t_r$ = 0.3 μs (Max)
  $t_s$ = 1.0 μs (Max)
  $t_f$ = 0.25 μs (Max)
- Complement to NPN 2N6339 thru 2N6341

**25 AMPERE**
**POWER TRANSISTORS**
**PNP SILICON**
**100, 120 VOLTS**
**200 WATTS**



**CASE 1–07**
**TO–204AA**
**(TO–3)**

**MAXIMUM RATINGS (1)**

| Rating | Symbol | 2N6437 | 2N6438 | Unit |
|---|---|---|---|---|
| Collector–Base Voltage | $V_{CB}$ | 120 | 140 | Vdc |
| Collector–Emitter Voltage | $V_{CEO}$ | 100 | 120 | Vdc |
| Emitter–Base Voltage | $V_{EB}$ | 6.0 | | Vdc |
| Collector Current — Continuous<br>Peak | $I_C$ | 25<br>50 | | Adc |
| Base Current | $I_B$ | 10 | | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 200<br>1.14 | | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$,$T_{stg}$ | –65 to +200 | | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.875 | °C/W |

(1) Indicates JEDEC Registered Data.

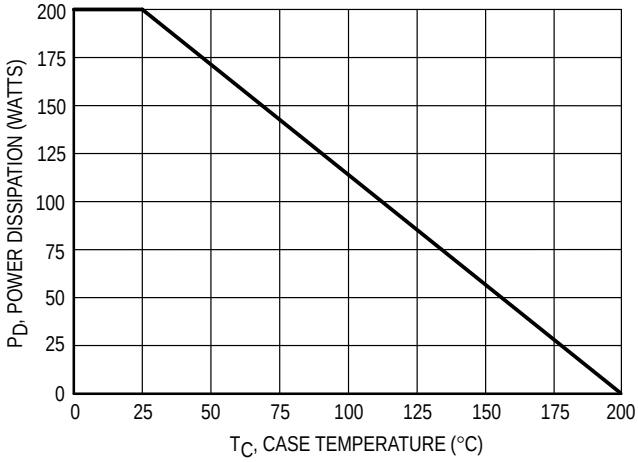



**Figure 1. Power Derating**

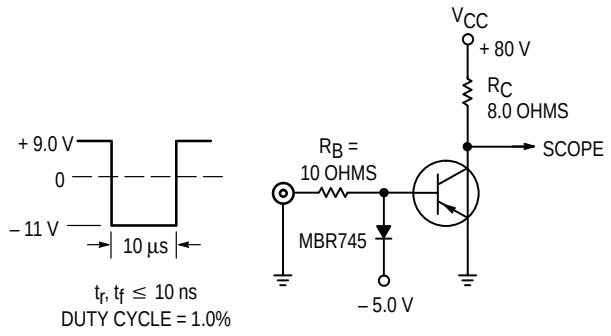
**Preferred** devices are Motorola recommended choices for future use and best overall value.

***ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Sustaining Voltage (1) | | $V_{CEO(sus)}$ | | | Vdc |
| ($I_C$ = 50 mAdc, $I_B$ = 0) | 2N6437 | | 100 | — | |
| | 2N6438 | | 120 | — | |
| Collector Cutoff Current | | $I_{CEO}$ | | | μAdc |
| ($V_{CE}$ = 50 Vdc, $I_B$ = 0) | 2N6437 | | — | 50 | |
| ($V_{CE}$ = 60 Vdc, $I_B$ = 0) | 2N6438 | | — | 50 | |
| Collector Cutoff Current | | $I_{CEX}$ | | | μAdc |
| ($V_{CE}$ = 110 Vdc, $V_{BE(off)}$ = –1.5 Vdc) | 2N6437 | | — | 10 | |
| ($V_{CE}$ = 130 Vdc, $V_{BE(off)}$ = –1.5 Vdc) | 2N6438 | | — | 10 | |
| ($V_{CE}$ = 100 Vdc, $V_{BE(off)}$ = –1.5 Vdc, $T_C$ = 150°C) | 2N6437 | | — | 1.0 | mAdc |
| ($V_{CE}$ = 120 Vdc, $V_{BE(off)}$ = –1.5 Vdc, $T_C$ = 150°C) | 2N6438 | | — | 1.0 | |
| Collector Cutoff Current | | $I_{CBO}$ | | | μAdc |
| ($V_{CB}$ = 120 Vdc, $I_E$ = 0) | 2N6437 | | — | 10 | |
| ($V_{CB}$ = 140 Vdc, $I_E$ = 0) | 2N6438 | | — | 10 | |
| Emitter Cutoff Current ($V_{EB}$ = 6.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | — | 100 | μAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain (1) | | $h_{FE}$ | | | — |
| ($I_C$ = 0.5 Adc, $V_{CE}$ = 2.0 Vdc) | | | 30 | — | |
| ($I_C$ = 10 Adc, $V_{CE}$ = 2.0 Vdc) | | | 20 | 120 | |
| ($I_C$ = 25 Adc, $V_{CE}$ = 2.0 Vdc) | | | 12 | — | |
| Collector–Emitter Saturation Voltage (1) | | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 10 Adc, $I_B$ = 1.0 Adc) | | | — | 1.0 | |
| ($I_C$ = 25 Adc, $I_B$ = 2.5 Adc) | | | — | 1.8 | |
| Base–Emitter Saturation Voltage (1) | | $V_{BE(sat)}$ | | | Vdc |
| ($I_C$ = 10 Adc, $I_B$ = 1.0 Adc) | | | — | 1.8 | |
| ($I_C$ = 25 Adc, $I_B$ = 2.5 Adc) | | | — | 2.5 | |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current–Gain — Bandwidth Product ($I_C$ = 1.0 Adc, $V_{CE}$ = 10 Vdc, $f_{test}$ = 10 MHz) | | $f_T$ | 40 | — | MHz |
| Output Capacitance ($V_{CE}$ = 10 Vdc, $I_E$ = 0, f = 100 kHz) | | $C_{ob}$ | — | 700 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Rise Time ($V_{CC}$ = 80 Vdc, $I_C$ = 10 A, $V_{BE(off)}$ = 6.0 Vdc, $I_{B1}$ = 1.0 Adc) | | $t_r$ | — | 0.3 | μs |
| Storage ($V_{CC}$ = 80 Vdc, $I_C$ = 10 A, $V_{BE(off)}$ = 6.0 Vdc, $I_{B1}$ = $I_{B2}$ = 1.0 Adc) | | $t_s$ | — | 1.0 | μs |
| Fall Time ($V_{CC}$ = 80 Vdc, $I_C$ = 10 A, $V_{BE(off)}$ = 6.0 Vdc, $I_{B1}$ = $I_{B2}$ = 1.0 Adc) | | $t_f$ | — | 0.25 | μs |

* Indicates JEDEC Registered Data.

(1) Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.




NOTE: For information on Figures 3 and 6, $R_B$ and $R_C$ were varied to obtain desired test conditions.

**Figure 2. Switching Time Test Circuit**

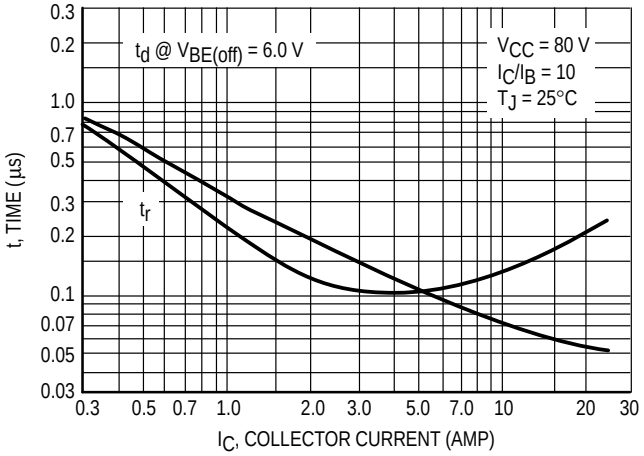



**Figure 3. Turn–On Time**

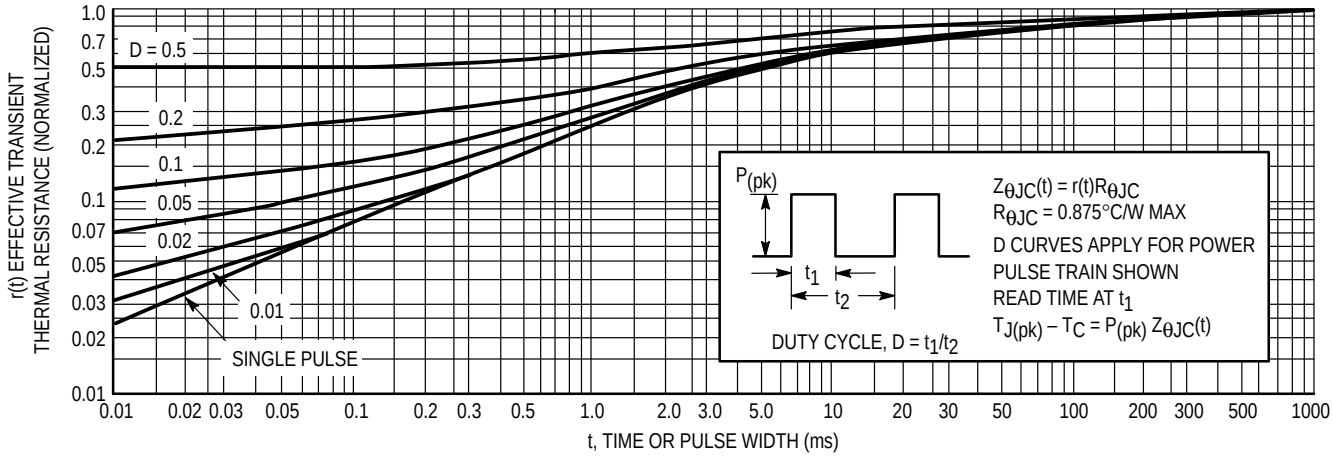



**Figure 4. Thermal Response**

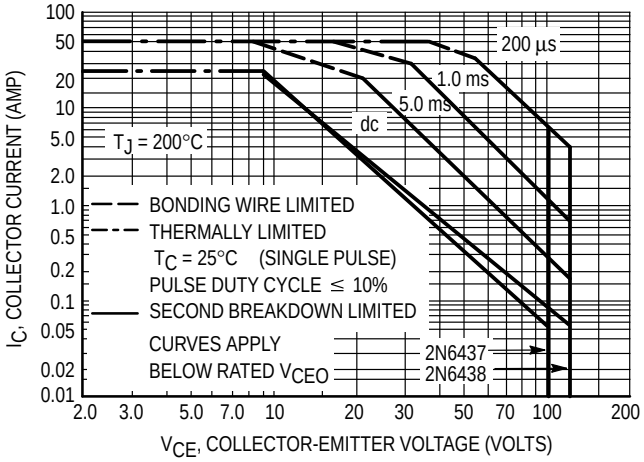



**Figure 5. Active Region Safe Operating Area**

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)}$ = 200°C; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

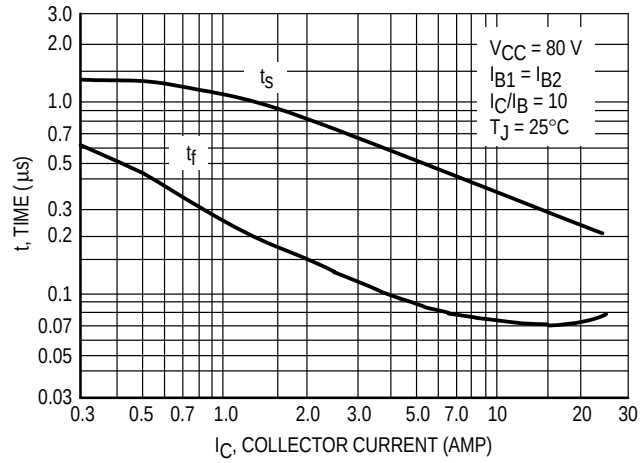



**Figure 6. Turn-Off Time**

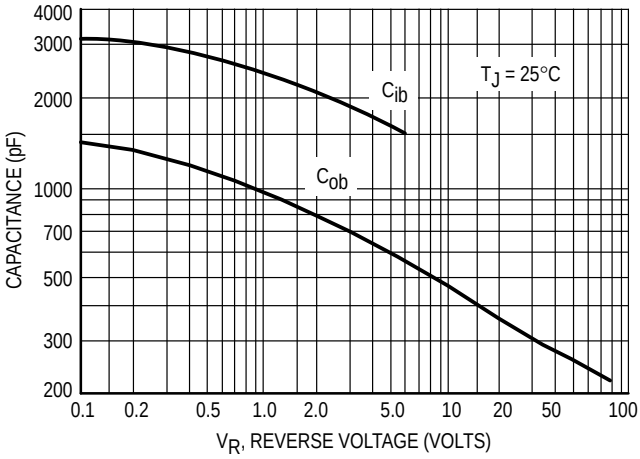



**Figure 7. Capacitance**

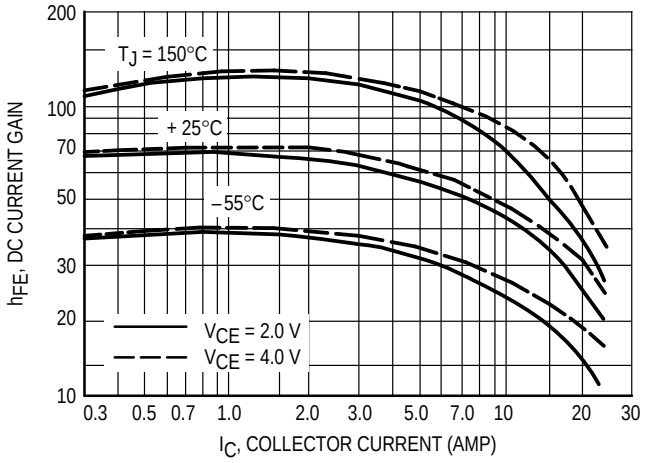



**Figure 8. DC Current Gain**

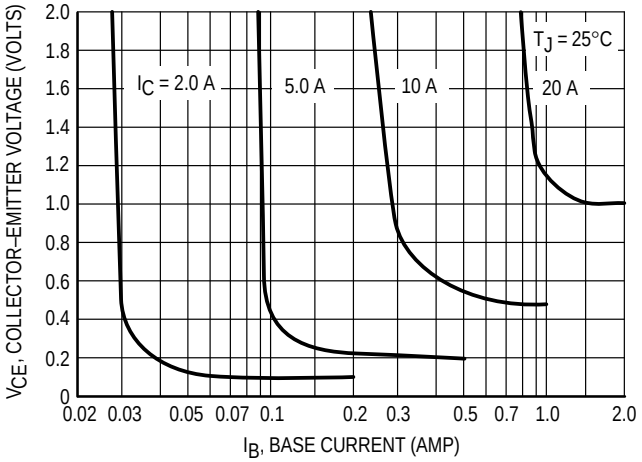



**Figure 9. Collector Saturation Region**

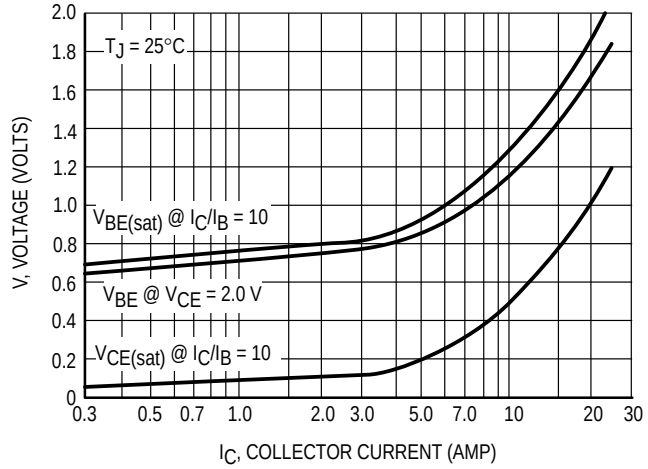



**Figure 10. “On” Voltages**

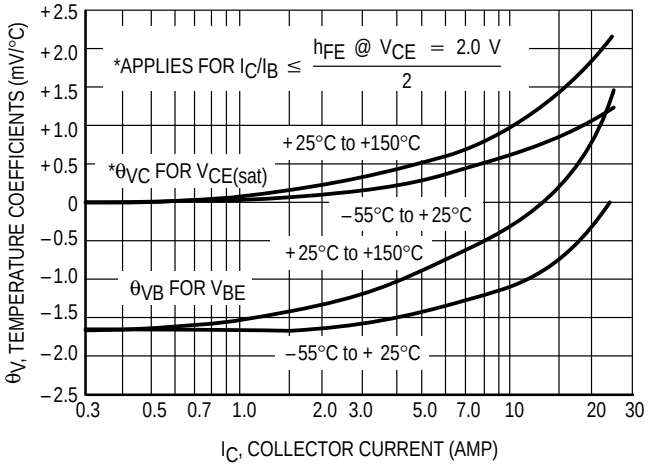



**Figure 11. Temperature Coefficients**

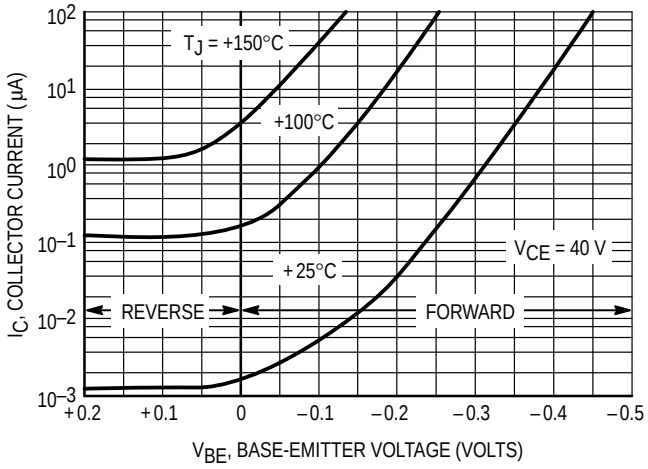



**Figure 12. Collector Cut-Off Region**

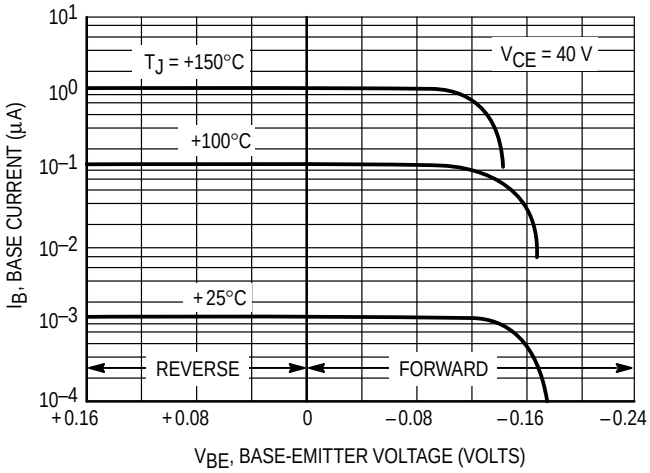
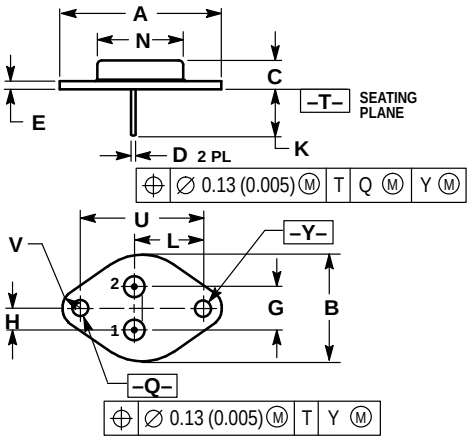



**Figure 13. Base Cutoff Region**

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO–204AA OUTLINE SHALL APPLY.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 1.550 REF | | 39.37 REF | |
| B | — | 1.050 | — | 26.67 |
| C | 0.250 | 0.335 | 6.35 | 8.51 |
| D | 0.038 | 0.043 | 0.97 | 1.09 |
| E | 0.055 | 0.070 | 1.40 | 1.77 |
| G | 0.430 BSC | | 10.92 BSC | |
| H | 0.215 BSC | | 5.46 BSC | |
| K | 0.440 | 0.480 | 11.18 | 12.19 |
| L | 0.665 BSC | | 16.89 BSC | |
| N | — | 0.830 | — | 21.08 |
| Q | 0.151 | 0.165 | 3.84 | 4.19 |
| U | 1.187 BSC | | 30.15 BSC | |
| V | 0.131 | 0.188 | 3.33 | 4.77 |

STYLE 1:
PIN 1. BASE
2. EMITTER
CASE: COLLECTOR

**CASE 1–07**
**TO–204AA (TO–3)**
**ISSUE Z**

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**JAPAN**: Nippon Motorola Ltd.; SPD, Strategic Planning Office, 141,
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan. 81–3–5487–8488

**ASIA / PACIFIC**: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298